pages, giving a charming and life-like account of the White Mountains of New Hampshire and the butterflies found there. This seems to be one of Mr. Scudder's most happy hunting-grounds, and is the only known home, with the exception of the Alps of Colorado, of *Œ. semidea*, the White Mountain butterfly, whose history comes next, and takes up no less than sixteen pages. These include the synonymy and references, which are full and appear accurate; two snatches of poetry (which, by the way, is freely scattered throughout the work); a description of the imago, covering two whole pages of close print; others of the egg, larva, and chrysalis, which take two more; geographical distribution occupies another page. The remainder is devoted to life-history and habits, and ends with a paragraph mentioning the desiderata left to be filled up before our knowledge of the history of the insect is complete.

Not so satisfactory, in my opinion, is the history of *Cercyonis* (*Satyrus*) *alope* and its near congener *nephele*, because, in the first place, not a word is said, in a generic description extending over three pages, to show how this genus differs (if it does differ) from the genus *Satyrus* or *Hipparchia*, in which the American species are included by other authorities; and, secondly, nothing is said as to whether this generic description is based on the two forms which alone are found in New England, or on the characters of other North American species; which, indeed, are not even named, though their existence is alluded to. As an instance of the difficulty of getting any agreement as to what constitutes a species among butterflies, even when they have been bred as largely, and studied as closely, as this species has been by W. H. Edwards, I may quote Mr. Scudder's remarks:—

> "It has been generally conceded of late years that these two types of butterflies were only dimorphic forms of a single species; and I have myself shared in this view, which has been supposed proven by breeding experiments and direct comparisons of a large amount of material made by Edwards, who, far more than all other observers together, has increased our knowledge of the natural history of these butterflies.
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> "He has instituted comparisons between them at every stage of life; and while he sees differences between caterpillars and chrysalids born of different types, he finds no constant and universal distinctions; while as to the relation of the early stages of the butterflies, he has proved by breeding that 'south of the belt of dimorphism,' as he calls that strip of country where *C. alope* and *C. nephele* both occur, '*alope* produced *alope*,' but inside the belt, *alope* produced intergrades, and *nephele* produced *alope* and also an intergrade. . . . That *nephele*, north of the belt, breeds true, is certain, because the intergrades and *alope* are not found here.
>
> "This would be conclusive if the complete parentage in each case were known; but, as only the mother was known in any case, another explanation is not only possible, but in view of all the facts probable. The intergrades found throughout the belt forming the northern boundary of the typical *alope*, and the southern boundary of the typical *nephele*, seem to be far more easily explainable on the hypothesis of hybridism, since they occur only where such a phenomenon is possible, and wherever it is possible. The same argument applied to the case of *Basilarchia*, as has been done by Edwards, would logically prove more than he would agree to, viz. the specific identity and trimorphism of all the eastern species except *Basilarchia archippus*. That the species of *Cercyonis* here described are certainly distinct, I would by no means maintain; only that, in view of the facts of distribution, it seems more probable that they should be looked upon as having reached in their development the stage of specific distinction, whilst they are readily fertile *inter se*, and produce intergrades, where they meet on common ground."

It seems to me, however, that there is yet another explanation, which, from what we know of the effect of heat and damp on the variation of butterflies of the same family in India, is even more probable; and that is, that the species is one which, having a wide range of distribution, is affected in the southern part of this range by climatic conditions which do not exist in its northern habitat, and has become modified in consequence, whilst in the central part of its range, the climatic conditions being more variable, the insect is also itself more variable. The most ardent devotee of minute subdivision of species cannot fail to allow, after Mr. de Nicéville's experiments on breeding in Calcutta, that climate can and does produce in the same locality, at different seasons, changes which are far greater than the difference which exists between *alope* and *nephele*, a difference which can be matched in other species of Satyridæ, about the specific identity of which there has hitherto been little or no question.

It does not seem to me logical for Mr. Scudder to treat of these two forms as different species, when he allows the specific identity of such forms as *Cyaniris* (*Lycæna*) *pseudargiolus*, *lucia*, *violacea*, and *neglecta*; this view being based, as it must be, on similar breeding experiments, carried out by the same naturalist, who proved to his own satisfaction and to mine the identity of *alope* and *nephele*.

A marked and novel feature of this work, which I cannot too highly praise, is the separated map of geographical distribution given on Plate 18 for most of the species dealt with in this part. On a small chart of the United States and Canada, the range of each species is coloured in brown, so that one can see at a glance what the distribution is; and though, no doubt, in the less known parts of the country these maps are not strictly exact, yet they give a very fair idea of what would otherwise require much reading to understand.

I look forward with the greatest interest to the succeeding parts, and to the early completion of, this most valuable work, which will take a high place among biological monographs, and will rank like Edwards's "Butterflies of North America," as one of the most important, beautiful, and painstaking books which America has ever produced

H. J. ELWES.

POLE'S LIFE OF SIEMENS.

The Life of Sir William Siemens, F.R.S. D.C.L., LL.D. By William Pole, F.R.S. (London: John Murray, 1888.)

IS it perhaps to the spirit of this book-making age that we ought to attribute the fact that examples of unsatisfactory biographies have been frequent in recent years? Perhaps works of this kind are too hurriedly compiled, and are laid before the friends and the public at a date too early to allow of such a memorial proving really satisfactory to the one class or to the other.

The compilation of a biography is almost proverbially difficult. To give a true and unbiased account of a life that has passed away, to show *the man* as he was and as he ought to be known, requires at all times delicacy, and tact, and peculiar ability in the writer to enter into the spirit of the life. The biography of a scientific man and of a great public character requires special gifts besides. But when the friend, the public man, has but recently stood among us, the difficulty is greatly enhanced. To hold the middle course between disclosing too much and too little; to avoid entering into particulars which might prove offensive to friends, or injurious to the material interests of those who are left to carry on the work of him who is gone, and yet to make the biography something more than a mere lifeless catalogue of events and undertakings, of successes and failures—to do this is difficult under any circumstances, almost impossible except after the lapse of many years.

We cannot feel that Mr. Pole's efforts have been crowned with entire success. Undoubtedly he has not erred on the side of indelicately disclosing what should not be made public. But above all things Siemens was sociable and friendly, domestic and hospitable, and ready to throw himself into the concerns of others, whether personal or scientific. This man, always kindly, always lovable, we find too little of in the biography now before us.

We cannot think that the form of writing which Mr. Pole has adopted is happy or advantageous. Chapter III., which gives an account of Siemens's school and college days, will probably be found, by general readers the most interesting part of the book. This is simply on account of the continuity in its style. The remaining chapters are divided into short sections, each with a separate heading in capitals or italics—like an American newspaper. Each one of these little sections gives an account of the progress of some invention during two or three years perhaps. The story then breaks off, and another invention is put before the reader. At the end of the chapter comes a short paragraph headed *Domestic Life*. Then the round recommences. Two or three hundred pages of these paragraphs leave the mind in a state of perfect bewilderment. We admit the difficulty of giving a continuous and interesting account of the life of this many-sided man; but we do not think it has been lessened by this method of treatment.

The letters also which are printed, with the exception of those from Dr. Werner von Siemens, the Berlin brother, are very disappointing. The remainder—from the Shah and other Princes, and from Ambassadors and secretaries of great men—are absolutely without interest. The same must be said of the pages of little obituary notices, many of them three lines long, from the morning and weekly newspapers.

Turning to the subject of the biography, our task is more congenial. A very chequered life lies before us, so far as anxiety and happiness are concerned—great failures, great successes, difficulties which to most men would have proved insuperable, enthusiastic determination and indomitable courage in this man which overcame them all, a life-long struggle steadily growing to remarkable success.

To those who knew Sir William Siemens only as the successful engineer of Palace Houses or the hospitable owner of Sherwood, as President of the British Association or of the Society of Telegraph-Engineers, it is instructive and interesting to trace his early days of mixed failure and success. His ingenuity and inventive power were very striking. At the age of twenty we find him making inventions in connection with electro-plating, governing of steam-engines, printing, &c., patenting them and selling the patents in England. His knowledge at this early age was, naturally, not equal to his enthusiasm and to his inventive fertility. The results obtained were by no means always satisfactory. Sometimes he made a little money: as often what he made by one invention was swallowed up almost to the last penny in endeavouring to realize or to bring forward something new.

Siemens's first undoubted success was his water-meter, in 1852. He had already been engaged in several important undertakings, besides having, early in life, taken many patents, to which we have just alluded; and he had invented and realized his regenerative heating, which subsequently became of the highest importance. But the water-meter supplied a real need in a thoroughly satisfactory way; and it was immediately taken up and yielded him a handsome income. With its success commenced the thorough success of its inventor, and he was thus, as Sir William Thomson remarks, "enabled eventually to find his home among us, and to give us primarily the benefit of his great inventiveness in all directions." It is interesting to chronicle this result, for there are many, to whom the name of Siemens is almost a household word, who have never so much as heard of the invention.

The two great engineering labours with which Siemens's name will always remain associated are electric telegraphy and regenerative heating. With regard to the former, the initiative seems to have come from Berlin, where his elder brother, Dr. Werner von Siemens, had commenced an electrical business about 1844. This business at first consisted in designing and making telegraph instruments; but soon the construction of land lines became a part of the work. About 1848, William Siemens was appointed agent in England for the Berlin firm; and his work grew with its growth. The time was, of course, opportune in the extreme. Soon we hear of the Berlin firm undertaking enormous land line contracts; and, naturally, when the time came, the English firm, which had arisen out of the agency of 1848, commenced to take part in the prodigious English work of girdling the earth with submarine cables. The history of these vast undertakings is most interesting; but unfortunately it is marred in the book before us by the misfortune of being scattered over many chapters, mixed up with a host of matters comparatively unimportant.

With regard to regenerative heating, we cannot do much more than remark that its importance is probably not yet fully realized. One great difficulty Siemens had to contend with was the cheapness of fuel! When he attempted to introduce his method among the salt manufacturers, it was scarcely worth their while to make the necessary changes in their evaporating plant so long as fuel could be so easily obtained. In works on the large scale, such as iron-making and glass making, the improvements introduced by him are already appreciated; and unfortunately the days cannot be very far distant when economy in fuel will become even more necessary than it is now.

Siemens, as is well known, had greatly at heart the subject of smoke abatement. He applied his principles to the construction of domestic fires, which are the main causes of smoke and fog in many of our large towns. His improvements have not yet to any considerable extent been adopted, but it is greatly to be desired that a reform in this direction should speedily be brought about.

To describe his labours in connection with the introduction of the electric light, the electric furnace, electric transmission of power, electric propulsion on railways, would be quite beyond our limits. We can only refer our readers to Mr. Pole's account of these subjects. The necessary explanations are given with admirable clearness, difficult as it is to compress them into moderate limits; and the book, in spite of our strictures at the commencement of this notice, will be found full of instruction and interest.

SOME PALÆOZOIC DIPNOAN FISHES.

Fauna der Gaskohle und der Kalksteine der Permformation Böhmens. Band II. Heft 3, Die Lurchfische, Dipnoi, nebst Bemerkungen über silurische und devonische Lurchfische. Pp. 65–92, Pls. 71–80. Von Anton Fritsch. (Prag: in Commission bei Fr. Řivnáč, 1888.)

ANOTHER part of Dr. Anton Fritsch's well-known work upon the Vertebrate fauna of the Permian rocks of Bohemia has lately appeared, and the description of the fishes is thus commenced. The nature of the subject does not admit of the introduction of so many novelties as characterized some of the previous parts; but the interest and value of the work is fully sustained, and the discussion of the characters of *Ctenodus*—the only known Dipnoan fish of the Bohemian Gas-coal—is supplemented by some remarks upon a few of its Palæozoic allies, with special reference to the supposed evidence of Dipnoans from the Upper Silurian of Bohemia. In addition to the ten beautifully-executed plates, the text is accompanied by numerous woodcuts, and no less than ten of these represent illustrative fossils that are not Bohemian, while six are devoted to important features in the skeletal anatomy of the living *Ceratodus.*

Dr. Fritsch commences by emphasizing the intimate relationship existing between the genera *Ctenodus* and *Ceratodus;* and each portion of the skeleton of the Permian fish, so far as determinable, is then compared in detail with the corresponding element in the existing genus. The fossils, unfortunately, are for the most part fragmentary, almost all the head-bones being scattered, and none of the bones of the trunk and fins being discovered in natural series; but many can be identified with considerable certainty when rigorously compared according to the author's method.

In the skull of *Ctenodus* there are several ossifications in parts that remain permanently cartilaginous in *Ceratodus,* and the dermal roof-bones are much more numerous than in the last-named genus. A bone that was formerly described as the pelvis of a Stegocephalian is now recognized as the squamosal of *Ctenodus.* There is no certain evidence of maxillæ and premaxillæ; and the mandible exhibits possibly another feature of close agreement with *Ceratodus* in the small size and scale-like character of the bone named dentary by Huxley. Dr. Fritsch considers that the latter element is too insignificant to represent the dentary, and may thus be more appropriately termed "dermomental"; but his argument appears to us far from satisfactory.

An interesting point is remarked upon in connection with the dentition of *Ctenodus.* The commonest of the two species recognized at Kounová was originally founded upon the evidence of detached teeth, and named *Ceratodus barrandei,* Fritsch; but it is now identified with the well-known English Coal-Measure species, *C. obliquus,* Hancock and Atthey. The teeth vary so much in size and so little in characters that Dr. Fritsch represents a series to illustrate several stages in the life-history of the fish; and the small teeth named *C. elegans,* Hancock and Atthey, thus appear to pertain merely to young individuals of *C. obliquus.*

Proceeding to a discussion of the axial skeleton of the trunk, Dr. Fritsch finds evidence of the persistence of the notochord, with the same arrangement of the neural and hæmal arches as is met with in *Ceratodus.* In regard to the parts of the appendicular skeleton, however, satisfactory comparisons are as yet impossible; though it is considered likely that, in the pectoral arch, *Ctenodus* exhibited a greater number of distinct elements than the existing genus.

The scales of *Ctenodus* are large, thin, and round, and the outer surface of each "appears smooth in the middle, and is only seen to be rugose when highly magnified. The border exhibits concentric lines of growth, of varying width, parallel to the margin. Across these extend small parallel ridges, on the middle of which are rows of minute pits, apparently indicating the spots that originally supported denticles." Another noteworthy feature is the forked appearance of the sensory canal upon a detached scale of the lateral line—a condition unknown in *Ceratodus.*

As the result of his researches, Dr. Fritsch concludes that the Bohemian examples of *Ctenodus obliquus* must have attained a length of about 140 centimetres. In every part of the skeleton there is evidence of more complete ossification than is observable in the existing *Ceratodus;* and the occurrence of a greater number of dermal roof-bones in the skull of *Ctenodus* as compared with that of the living Dipnoan is a parallel case to that of the Amphibia previously discussed,—the Permian groups having the skull better armoured than their allies at present existing.

After defining the teeth of a new species (*C. applanatus*) from the Gas-coal of Kounová, and having also briefly noticed another form (*C. trachylepis*) known only by three scales from Nyřan, Dr. Fritsch proceeds, in conclusion, to treat of some of the remains of Dipnoan fishes met with in the Devonian and Silurian, mostly of the Continent. A new genus and species, *Dipnoites perneri,* is indicated by a supposed head-bone from the Upper Silurian of the neighbourhood of Prague. A new and more satisfactory figure of the type-specimen of *Gompholepis panderi,* Barrande, is next given; and this, too, is regarded as